

2.2.4 Paleontology

Paleontological resources include fossil remains and their respective fossil localities, associated fossil specimen data and corresponding geologic and geographic locality data, and the fossil-bearing rock units that immediately underlie the ground surface. Fossils, in turn, are the remains of ancient organisms that are preserved in sedimentary strata of the earth's crust. Fossils are considered an important scientific resource because of their use in (1) documenting the evolution of particular groups of organisms, (2) reconstructing the environments in which they lived, and (3) in determining the ages of these rock units in which they occur and of the geologic events that resulted in the deposition of the sediments constituting the rock units.

2.2.4.1 Regulatory Setting

Paleontology is a natural science focused on the study of ancient animal and plant life as it is preserved in the geologic record as fossils. A number of federal statutes specifically address paleontological resources, their treatment, and funding for mitigation as a part of federally authorized projects. The following laws and regulations are applicable to this project: Antiquities Act of 1906 (16 U.S.C. 431-433) prohibits appropriating, excavating, injuring, or destroying any object of antiquity situated on federal land without the permission of the Secretary of the Department of Government having jurisdiction over the land. Fossils are considered "objects of antiquity" by the Bureau of Land Management, the National Park Service, the Forest Service, and other federal agencies; 23 U.S.C. 1.9(a) requires that the use of federal-aid funds must be in conformity with federal and state law; and Federal-Aid Highway Act of 1960 (23 U.S.C. 305) authorizes the appropriation and use of federal highway funds for paleontological salvage as necessary by the highway department of any state, in compliance with 16 U.S.C. 431-433. Under California law, paleontological resources are protected by CEQA.

2.2.4.2 Affected Environment

This section has been prepared based on the analysis and findings presented in the *Paleontological Identification Report and Paleontological Evaluation Report* (PIR/PER) (December 2015).

Geologic maps and reports portraying the surficial geology of the project area were reviewed to determine the sedimentary units exposed therein, particularly those units known to be fossiliferous, and to delineate their respective areal distributions in the project area. Published and unpublished geologic and paleontological literature was reviewed to document the number and locations of previously recorded fossil localities in the project area and vicinity from each

rock unit exposed in the project area. The types of fossil remains the unit had produced locally and the taxa represented by the remains were also documented. The literature review was supplemented by archival searches done at the Natural History Museum of Los Angeles County (LACM) Vertebrate Paleontology Department for additional information on the occurrences of fossil localities in the same stratigraphic units in the project area and vicinity, and the types of fossil remains that were recovered at these localities. A second archival search was conducted at LACM after the project area was modified.

A pedestrian field survey of the project construction zone was accomplished on August 15, 2015. The survey was undertaken to document the condition of any previously recorded fossil locality therein, the occurrence of any unrecorded fossil locality, and the presence of strata suitable for containing fossil remains. Because most of the project area, which is underlain by undissected late Quaternary strata, is developed for transportation purposes and, therefore, covered by pavement and landscaping, there is little exposure of the underlying strata. Consequently, only obvious exposures in roadcuts, primarily those of the Vaqueros Formation along the ramps of the I-405/SR-133 interchange, were inspected on foot.

The project area is situated along the southeastern margin of the Tustin Plain, immediately north of the San Joaquin Hills. The Tustin Plain is a comparatively featureless lowland or floodplain, the eastern end of which is bounded to the northeast by Loma Ridge and to the south by the San Joaquin Hills. Regional surficial geologic mapping indicates that the project area is underlain by six sedimentary stratigraphic units of later Cenozoic age. In ascending stratigraphic order, these units include (1) the early Miocene marine Vaqueros Formation, (2) early to middle Pleistocene Very Old Alluvial Fan Deposits, (3) early to middle Pleistocene Very Old Axial Channel Deposits, (4) middle to late Pleistocene Old Paralic Deposits overlain by Alluvial Fan Deposits, (5) late Pleistocene to Holocene Young Alluvial Fan Deposits, and (6) late Pleistocene to Holocene Young Axial Channel Deposits. The latter two sedimentary units immediately underlie most of the Tustin Plain, are flat lying and comparatively undissected and unconsolidated, and of Recent or Holocene age at and very near the current ground surface, but become progressively older with increasingly greater depths below the surface.

The Vaqueros Formation, Very Old Axial Channel Deposits, Old Paralic Deposits overlain by Alluvial Fan Deposits, and, at depths at least 6 feet below the previous ground surface, Young Alluvial Fan Deposits have produced the fossilized remains of mostly extinct vertebrate and invertebrate animal species at numerous, previously recorded fossil localities elsewhere on, or adjacent to, the Tustin Plain. Moreover, the remains of marine snails, clams, barnacles, and sand dollars were found at two newly recorded fossil localities in Vaqueros Formation as a

result of the field survey conducted in support of the PIR/PER. Earth-moving activities where the project area is underlain by these rock units are considered to have a high potential for encountering additional similar remains. On the other hand, earth-moving activities where the project area is underlain by Very Old Alluvial Fan Deposits and, at depths at least 6 feet below the current ground surface, Young Axial Channel Deposits are also considered to have a high potential for encountering additional similar remains because (1) the Very Old Alluvial Fan Deposits are regarded as laterally equivalent to the fossiliferous Very Old Axial Channel Deposits, and (2) the Young Axial Channel Deposits were mapped previously with the fossil-bearing Young Alluvial Fan Deposits as Alluvium. Figure 2.2.4-1 shows the locations of these formations in the project area.

Paleontological resources are considered to be significant if they provide new data on fossil animals, distribution, evolution, or other scientifically important information as previously stated. Caltrans uses a tripartite scale to characterize paleontological sensitivity.

High Potential: Rock units that, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils. These units include sedimentary formations that contain significant nonrenewable resources anywhere within the geographic extent.

Low Potential: Rock units that are not known to have produced significant fossils in the past but possess a potential to contain fossils or those that yield common fossil invertebrates.

No Potential: Rock units with no potential to contain fossils. This includes most rocks of igneous origin or metamorphosed transformation.

2.2.4.3 Environmental Consequences

Alternative 1 (No Build)

The No Build Alternative would have no surface or subsurface impacts; therefore, it would not create adverse permanent or temporary impacts to potential paleontological resources.

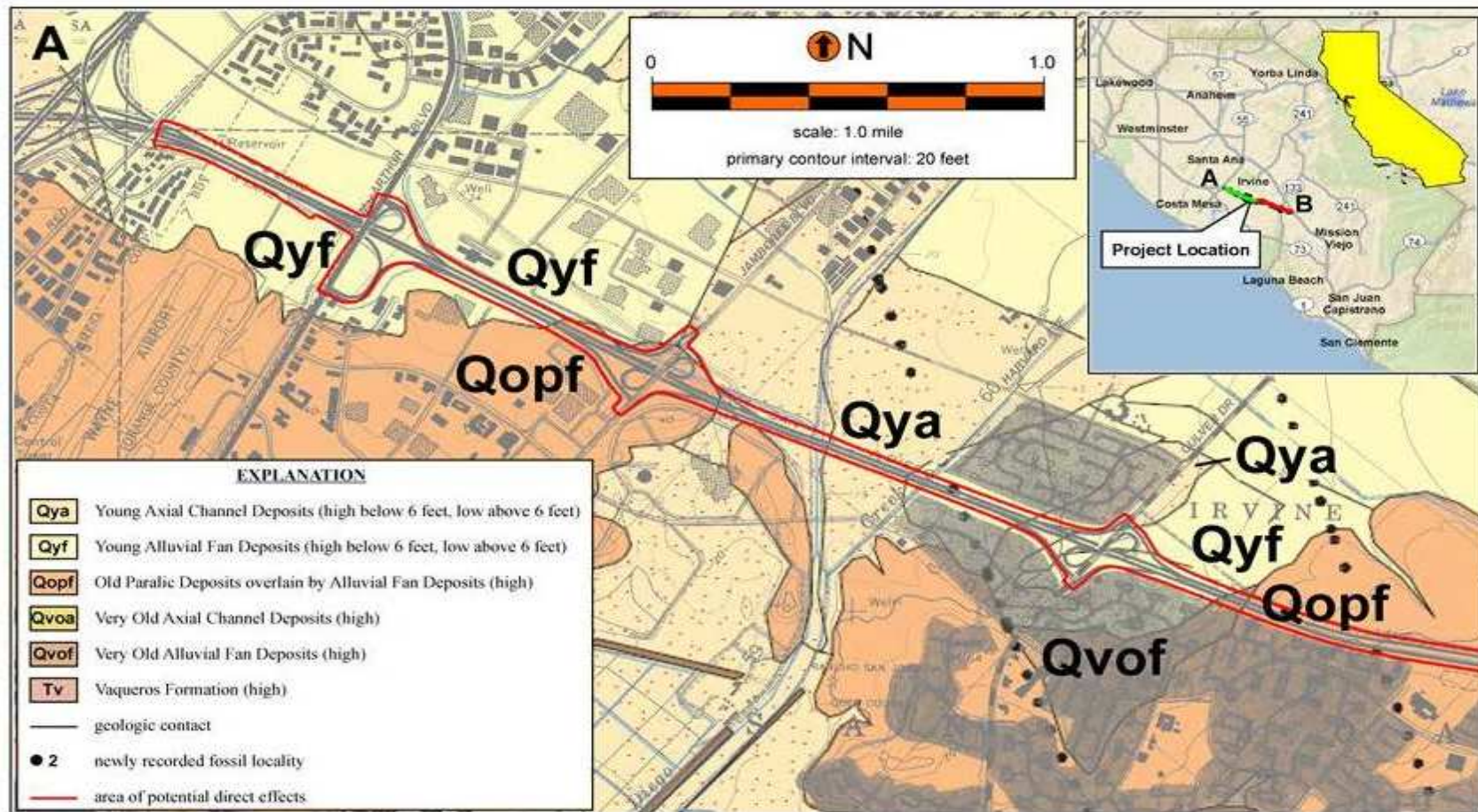


Figure 5.—Topographic and surficial base maps showing paleontological resource importance and impact sensitivity by rock unit, Interstate 405 Improvements Project area, Orange County, California. Surficial geology after Morton and Miller (2006). Newly recorded fossil localities discovered during field survey conducted in support of this PIR/PER. A. Topographic base map: USGS Tustin Quadrangle, California, Orange Co., 7.5-Minute Series (Topographic) (1965, photorevised 1981, respectively). B. Topographic base maps: Tustin Quadrangle and USGS El Toro Quadrangle, California, Orange Co., 7.5-Minute Series (Topographic) (1968, photorevised 1982).

Figure 2.2.4-1. Paleontological Resources in the Project Area (Sheet 1 of 2)

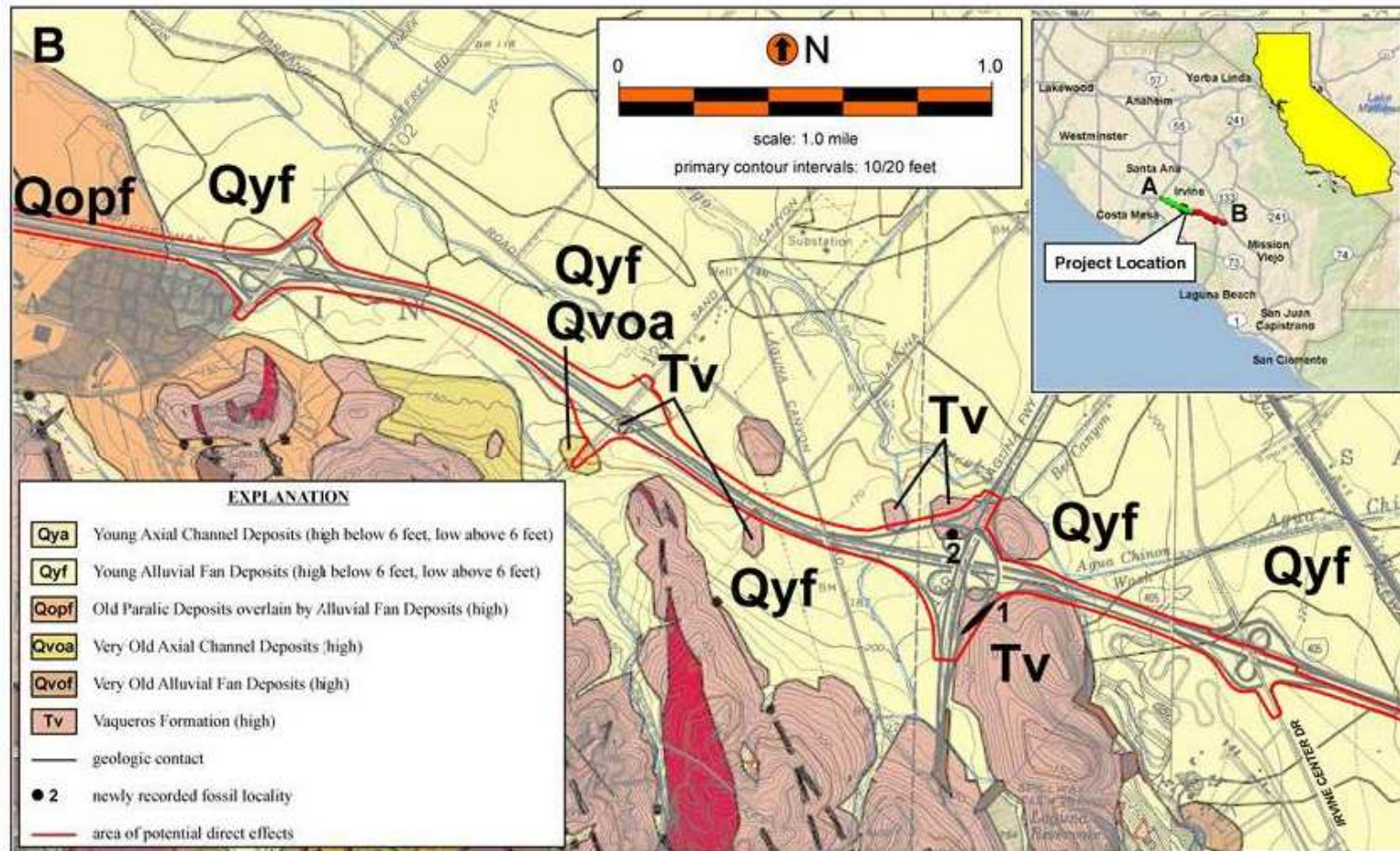


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Figure 2.2.4-1. Paleontological Resources in the Project Area (Sheet 2 of 2)

Build Alternative 2 (Preferred Alternative) and Build Alternative 3

Construction (Short-Term) Impacts

Construction-related earth-moving activities would have a potential to affect paleontological resources in areas underlain by the Vaqueros Formation, Very Old Alluvial Fan Deposits, Very Old Axial Channel Deposits, Old Paralic Deposits overlain by Alluvial Fan Deposits, and, at depths at least 6 feet below current grade, Young Alluvial Fan Deposits and Young Axial Channel Deposits, as shown in Table 2.2.4-1. Potentially affected resources might include currently unrecorded fossil remains and the respective fossil localities (particularly those remains and localities discovered during field survey conducted for the PIR/PER), associated specimen data and corresponding geologic and geographic locality data, and the fossil-bearing strata.

Table 2.2.4-1. Impact Magnitude by Stratigraphic Rock Unit and Alternative

Rock Unit	Impact Magnitude		
	Alternative 1 (No Build)	Alternative 2 (Preferred Alternative)	Alternative 3
Young Axial Channel Deposits (Qya) (depths above 6 feet)	None	Low	Low
Young Axial Channel Deposits (Qya) (depths below 6 feet)	None	High	High
Young Alluvial Fan Deposits (Qyf) (depths above 6 feet)	None	Low	Low
Young Alluvial Fan Deposits (Qyf) (depths below 6 feet)	None	High	High
Old Paralic Deposits overlain by Alluvial Fan Deposits (Qopf)	None	High	High
Very Old Axial Channel Deposits (Qvoa)	None	High	High
Very Old Alluvial Fan Deposits (Qvof)	None	High	High
Vaqueros Formation (Tv)	None	High	High

Source: District Preliminary Geotechnical Report, December 2015.

Earth-moving activities would include excavation for those segments of roadways where new GP and auxiliary lanes would be added, particularly with regard to Alternative 3. In contrast to Alternative 2, two GP lanes would be added in each direction under Alternative 3 instead of just one. Consequently, the impacts of Alternative 3 on paleontological resources would be greater than those of Alternative 2.

Areas of low paleontological importance – Young Alluvial Fan Deposits and Young Axial Channel Deposits – underlie approximately 90 percent of the entire project area. In total, areas of high paleontological importance – the Vaqueros Formation, Very Old Alluvial Fan Deposits, Very Old Axial Channel Deposits, and Old Paralic Deposits overlain by Alluvial Fan Deposits – underlie only approximately 10 percent of the project area.

Both build alternatives would also include two soundwalls and six structures (one new connector structure, two existing bridge widenings, and three ground anchor walls), all of which are located in areas of low paleontological importance. Additionally, two existing bridge widenings, and three ground anchor walls would involve earth-moving activities in areas previously disturbed by construction of I-405 and subsequent improvements to the facility. The three new structures – (1) N133/S133 to N405 Connector Braided Ramp Structure, (2) Soundwall S322 (Option 1), and (3) Soundwall 255 – are located in areas of low paleontological importance; however, these structures may disturb areas that may not have yet been disturbed by I-405 construction or improvements. Additionally, construction of these new structures would likely involve disturbance at depths below 6 feet.

The implementation of appropriate avoidance, minimization, and mitigation measures providing for the recovery and treatment of any scientifically important fossil remains and/or paleontological salvage exposed by earthmoving activities within the jobsite, would reduce the adverse effects to paleontological resources.

2.2.4.4 Avoidance, Minimization, and/or Mitigation Measures

The following avoidance, minimization, and/or mitigation measures will be implemented with the project and would minimize, avoid or mitigate impacts related to paleontological resources. Standardized measures which are employed on most, if not all, Caltrans projects are indicated in bold.

- PAL-1: A standard special provision for paleontology mitigation will be included in the construction contract special provisions section advising the construction contractor of the requirement to cooperate with paleontological salvage.
- PAL-2: A qualified Principal Paleontologist approved by Caltrans will prepare a detailed Paleontological Mitigation Plan (PMP) prior to the start of construction. The Paleontologist will have an M.S. or Ph.D. degree in paleontology or geology and will be familiar with paleontological salvage or mitigation procedures and techniques. The PMP will detail the paleontological monitoring to be implemented

during construction and shall include, at a minimum, a description of the following elements:

- Caltrans will perform paleontological monitoring and salvage during construction operations or related activities involving subsurface disturbance on this project. Within the boundaries of the project area, no construction or related activities that might involve subsurface disturbance of paleontologically sensitive geologic formations will be allowed without written authorization of the Engineer and the presence of a Paleontological Monitor. Caltrans will provide a Paleontological Salvage Team consisting of a qualified State-contracted Principal Paleontologist and Paleontological Monitors. The Engineer will make arrangements for the Paleontological Salvage Team to be at the jobsite. Rock units that require monitoring no matter depth of excavation are as follows:
 - Old Paralic Deposits overlain by Alluvial Fan Deposits (Qopf) on both sides of Jamboree Road between Culver Drive and Jeffrey Road
 - Very Old Axial Channel Deposits (Qvoa) on Sand Canyon Avenue
 - Very Old Alluvial Fan Deposits (Qvof) located east of Culver Avenue
 - Vaqueros Formation (Tv) from Sand Canyon Avenue to east of Irvine Center Drive
 - Although monitoring will be conducted on a full-time basis in all of the areas underlain by those rock units (except those areas underlain by Young Alluvial Fan Deposits and Young Axial Channel Deposits and where earth-moving activities will not reach 6 feet below the current ground surface), monitoring will be reduced to part time or spot checking in areas underlain by Very Old Alluvial Fan Deposits and Young Axial Channel Deposits if no fossil remains have been discovered after 50 percent of earth-moving activities in the latter areas has been completed.

Rock units and corresponding parts of project construction in which earth-moving activities will not require monitoring unless there are excavation depths below 6 feet are as follows:

- Young Axial Channel Deposits (Qya) from Jamboree Road to Culver Drive
- Young Alluvial Fan Deposits from MacArthur Boulevard to Jamboree Road, east of Culver Drive, and west of Jeffrey Road to Irvine Center Drive

- The Paleontological Salvage Team will be notified 15 days in advance of the start of subsurface disturbing operations.
- The construction contractor will attend a preconstruction meeting with the Paleontological Salvage Team and the Engineer to establish procedures for cooperation and provide for worker safety during monitoring and salvage activities. The Principal Paleontologist and Caltrans Paleontology Coordinator will be present at pregrading meetings to consult with grading and excavation contractors.
- Just prior to the beginning of earth-moving activities, the Principal Paleontologist will conduct an employee environmental awareness training session for all persons involved in earth-moving activities for the project. All employees, subcontractors, and contractor's representatives involved in subsurface disturbing activities in the project area must receive a 1-hour paleontological resource awareness training program provided by the Paleontological Salvage Team before performing onsite work. A written request for the paleontological awareness training is to be submitted to the Engineer 10 days before the performance of any work.
- Before the start of earth-moving activities, the Paleontological Salvage Team will conduct a preconstruction field survey of the project area, and exposed fossil remains will be recovered, as appropriate, particularly with regard to those remains observed at the two newly recorded fossil localities discovered during the field survey conducted in support of the PIR/PER for this project. A qualified Paleontological Monitor under the direction of the Principal Paleontologist will be onsite to inspect fresh cuts for fossils at all times during original earth-moving activities involving sensitive geologic formations. If necessary, additional personnel will be assigned to recover unusually large or productive fossil occurrence.
- The Paleontological Salvage Team will monitor and salvage appropriate fossil specimens identified during earth-moving activities. Members of the Paleontological Salvage Team may temporarily divert or stop construction operations in the vicinity of a fossil occurrence or notify of the need to avoid disturbing the fossil locality pending removal of the specimens. When fossils are discovered, the Paleontological Monitor will recover them and contact a Principal Paleontologist for assistance, if needed. Construction work in these areas will be halted or diverted to allow for the recovery of fossil remains in a timely manner.

- As determined necessary by the Principal Paleontologist, bulk sediment samples will be recovered from fossiliferous horizons and fully processed (wet screened, sorted) to allow for the recovery of microvertebrate remains. If warranted, splits of selected samples will be submitted to the appropriate laboratories for processing and analysis. Processing splits will allow for the recovery and analysis of other types of microfossils, including ostracods, diatoms, and/or pollen.
- Fossil remains collected during the monitoring and salvage phase of the mitigation program will be prepared to a point allowing identification, stabilized, and cataloged. Recovered specimens will be prepared and identified to the lowest taxonomic level possible by appropriate paleontological specialists.
- Prepared fossils, along with copies of all pertinent field notes, photos, and maps, will then be deposited in a Caltrans-approved scientific institution with paleontological collections and made available for future scientific study by qualified investigators.
- A Paleontological Mitigation Report (PMR) that outlines the results of the mitigation program will be prepared and signed by the Principal Paleontologist. A copy of the report will be supplied to the museum repository and approved by Caltrans.
- At the completion of the project and as appropriate, the Caltrans Paleontology Coordinator will prepare a paleontology stewardship summary with a list of any long-term commitment. The list will be provided to Maintenance and Operations staff, including the Encroachment Permits Office.

PAL-3: If paleontological resources are discovered at the jobsite, the material will not be disturbed. All work within a 60-foot radius of the discovery will stop, the area will be protected, and the Engineer will be notified. Caltrans will investigate and modify the dimensions of the protected area if necessary. Paleontological resources will not be removed from the jobsite without authorization. Work will not resume within the specified radius of the discovery until authorized. If unanticipated fossil remains are discovered in an area of the project area not being actively monitored, the remains will not be disturbed.